South Carolina Department of
Natural Resources

Paul A. Sandifer, Ph.D.
Director
John V. Miglarese
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12 February 2003

Randi Neff, Grants Administrator
NOAA Office of Ocean Exploration
1315 East West Highway
SSMC3, Room 10232
Silver Spring MD 20910

Dear Ms. Neff:

Enclosed is the semi-annual progress report for the project (NA16RP2697): "Characterization of Deep Reef Habitat off the Southeastern U.S., with Particular Emphasis on Discovery, Exploration and Description of Reef Fish Spawning Sites." This report covers activities conducted during the first six-month period of the project, from 1 June 2002 through 1 December 2002.

We have made significant progress on our objectives. We had a successful cruise and have begun processing the samples from that cruise. We have made several education/outreach presentations.

If you have any questions or comments regarding this report, please contact me.

Sincerely,

George R. Sedberry

P.O. Box 12559 • Charleston, S.C. 29422-2559 • Telephone: 803-795-6350

Semi-Annual Progress Report

A.: Grant Number: NA16RP2697

B.: Grantee: George R. Sedberry, Marine Resources Research Institute, South Carolina Department of Natural Resources

C.: Project Title: Characterization of Deep Reef Habitat off the Southeastern U.S., with Particular Emphasis on Discovery, Exploration and Description of Reef Fish Spawning Sites

D.: Amount of Grant: Federal $ 30,000 **Match** $ 19,180 **Total** $ 49,180

E.: Award Period: From 1 Jun 2002 **To** 31 May 2003

F.: Period Covered by this Report: From 1 Jun 2002 **To** 1 Dec 2002

G.: Summary of Progress and Expenditures to Date:

1. Work Accomplishments:

a. Describe activities scheduled for this half. (from proposal and amendments, if appropriate).

The objectives of this project are to:

1. To locate spawning grounds of deep reef fishes in the SAB by sampling locations of capture of reef fishes with hydrated oocytes (HOs) and postovulatory follicles (POFs), which indicate imminent or recent spawning.
2. To confirm spawning by observing reef fishes during diurnal and crepuscular spawning periods using submersible.
3. To describe fish assemblages associated with these deep reefs.
4. To describe benthic habitats, reef structure, substrates and sediments of spawning locations.
5. Do describe oceanographic features near, upstream and downstream from spawning locations.
6. To describe megafaunal invertebrate assemblages and macrobenthic invertebrate assemblages from video and removal sampling, respectively, using submersible and grab sampler.
7. To collect early life history stages to confirm spawning and to detect transport patterns of larvae in relation to oceanographic features.
8. To map (GIS) spawning habitats and bottom features, including substrates, mega-epifaunal assemblages, infaunal assemblages, fish assemblages, and distribution of early life history stages of fishes using submersible observations and collections.
9. To compare spawning sites to other deep reef habitats.
10. Develop educational materials for broad and narrowly-defined audiences, based on results obtained.

Activities scheduled for this project period included:

1. Field work, including submersible dives, ichthyoplankton collections and oceanographic sampling.
2. Analysis of representative samples.
3. Preparation of educational materials.

b. Describe activities accomplished this period.

Most activities during this period concentrated on field sampling.

Islands in the Stream 2002 Expedition

Project personnel participated in a cruise to several reef fish spawning and potential protected area sites from 27 Jul – 5 Aug 2002, and in post-cruise educational activities aboard the research vessel during an open house in Charleston SC (Fig. 1). The mission has been summarized in reports available at the NOAA Ocean Exploration web site, and will be briefly summarized here. We conducted submersible operations at several reef sites from northern Florida to northern South Carolina (Fig. 1). In addition to submersible observations, we conducted sampling of ichthyoplankton to supplement other NOAA-funded Charleston Bump research we are conducting (Fig. 2), and we collected (grab) sediments for contaminant analysis at each dive site. In addition, we conducted side scan sonar and fathometer surveys of dive sites and other potential MPA sites.

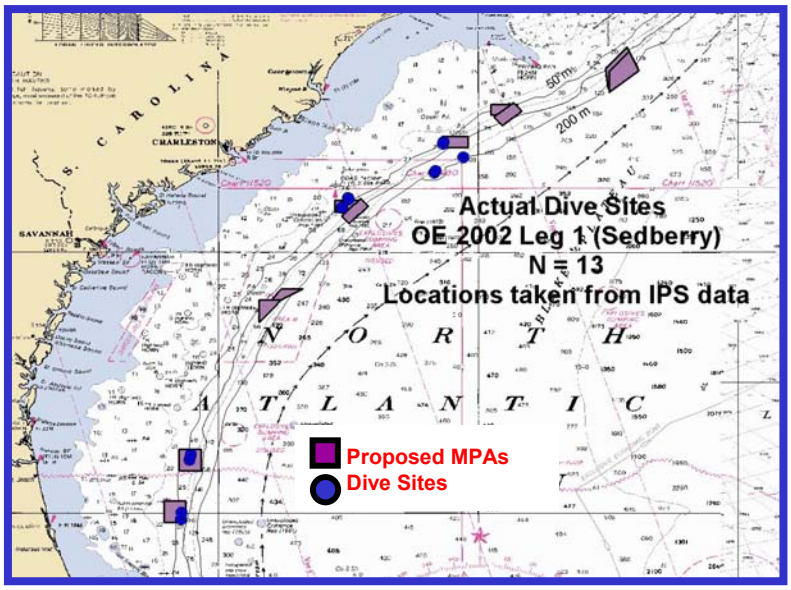

Figure 1. Location of submersible dive sites for the Islands in the Stream 2002 expedition. Sonar, plankton and hydrographic collections were also made at most sites. Several dive sites correspond to sites being considered as Marine Protected Areas (MPAs) by the SAFMC.

We used historic (MARMAP) data on capture locations of reef fishes in spawning condition to direct submersible and shipboard sampling of spawning locations. The successful cruise included 13 sub dives that resulted in 34 hours of annotated digital video of shelf reef habitat and fauna, including an invasive fish species (red lionfish, *Pterois volitans*). In addition, more than 25 hours of side scan sonar, supplemented by 25 hours of fathometer transects, produced high-resolution topographic images reef morphology and suspected reef fish spawning grounds.

The IIS Expedition Charleston Bump Mission began on 26 July 2002, when project personnel and other cruise participants traveled to Ft. Pierce FL to board R/V *Seward Johnson*.

The *Seward Johnson* then proceeded to the shelf edge reef sites (Fig. 1). At each site, we conducted submersible dives, plankton tows, grab samples and side scan sonar transects. Two of the northern sites along the 200-m depth contour were in the Charleston Gyre, an area where previous hydrographic measurements by the investigators indicated high productivity due to deflection of the Gulf Stream at the Charleston Bump. We were particularly interested in looking for spawning deep reef fishes like snowy grouper and blueline tilefish at these two sites. Although we did not observe spawning in these two species, we were able to make observations on their abundance and habitat preferences, and were able to make additional hydrographic measurements in this important feature of the Charleston Bump complex. We observed courtship and other reproductive behaviors (e.g. nest guarding) in hogfish, scamp, speckled hind, gray triggerfish and red snapper at shallower (50-60 m) shelf-edge reefs.

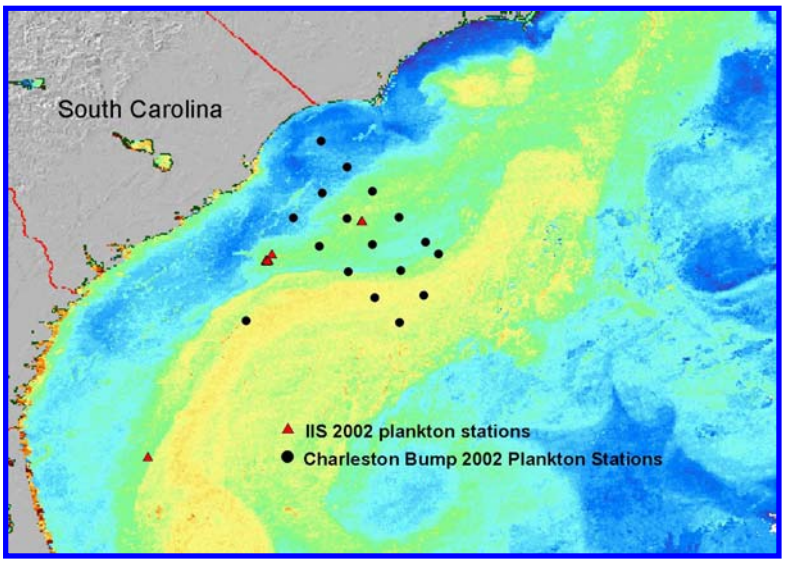

Figure 2. Location of plankton stations (red triangles) sampled in during the OE Mission in 2002. Collections were made at Gulf Stream fronts and in the Charleston Gyre. These samples will complement those collected on another NOAA-funded study of the Charleston

In addition to observing and collecting demersal fishes, we were able to make several plankton tows (Fig. 2). This enabled us to obtain additional larval fish samples from a different time of year than we have previously been able to sample. During the cruise, ichthyoplankton was sampled 14 times with 1 mm neuston net attached to a 2 x 1 m frame and a 60-cm bongo frame equipped with 0.5 mm and 1 mm nets.

The IIS Expedition culminated in Ocean Exploration Day in Charleston SC on 5 August 2002, and project personnel participated in educational programs for teachers and students, in which classes learned about the importance of shelf-edge and slope reefs, the Charleston Bump Complex, and marine protected areas.

Laboratory Analysis

Because of a severe reduction in funding relative to what was requested, laboratory analysis has proceeded slowly. However, project personnel at the NOAA Center for Coastal Environmental Health and Biomolecular Research (CCEHBR) in Charleston will begin to process the benthic samples over the next few months with additional outside funding identified to perform this task . This includes the samples collected by submersible from sediments at varying distances from the reef, in order to look at the effect of fish aggregations on benthic community structure.

Project personnel have begun reviewing the submersible videotapes. They will be looking at trends in the abundance of dominant epifaunal invertebrates at different depths and sites.

Sponges that were collected in depths from 58-215 m are being identified. Two have been dissected and the associated fauna have been categorized into taxonomic groups. Faunal associates include amphipods, ophiuroids, polychaetes, mysids, and isopods.

All ichthyoplankton samples collected during the cruise have been sorted for occurrence of priority fish species. Taxa of priority interest have been removed from the samples for counting, measuring and adding to our ichthyoplankton database. Priority taxa include scombrids (tunas and mackerels), coryphaenids (dolphins) and istiophorids (billfishes).

Hydrographic data collected during the cruise have been incorporated into the Charleston Bump database, and will be used for examining maps of horizontal distribution of oceanographic parameters and for constructing vertical profiles of hydrographic conditions in the region of the Charleston Gyre. These data and maps will be used to describe circulation and upwelling in relation to the fish spawning sites and larval fish collections.

Students at the College of Charleston, under direction of project investigators, are analyzing sediment samples (grain size) collected from Georgetown Hole, Charleston Lumps (north and south), and from Charleston Bump (collected during a 2001 OE mission) to compare sediments along a shelf-edge to upper slope to mid-slope transect. Another student is examining fossil mollusk assemblages along the shelf-edge, using samples collected during the 2002 mission.

Education and Outreach

In addition to participating in at-sea and open house education and outreach efforts, project personnel have made several educational and scientific presentations on the 2002 mission and preliminary results. These include the following:

Sedberry, G.R. 2002. Ocean Exploration: Islands in the Stream. Seminar, Masters in Environmental Studies Program, College of Charleston. September 2002.

Sedberry, G.R. 2002. Ocean Exploration: Islands in the Stream. Seminar, Graduate Program in Marine Biology, Grice Marine Lab, College of Charleston. October 2002.

Sedberry, G.R. 2002. Ocean Exploration: Islands in the Stream. Presentation to Habitat and Environmental Protection and Coral Advisory Panels Joint Meeting, South Atlantic Fishery Management Council, Charleston SC. October 2002.

Sedberry, G.R., A.O. Ball, R.W. Chapman, J.C. McGovern and M.S. Zatcoff. 2002. Connectedness of exploited reef fish faunas of the U.S. South Atlantic Bight and northern Gulf of Mexico. 132nd Annual Meeting, American Fisheries Society, Baltimore MD. August 2002 (presented by GRS).

Sedberry, G.R., and J.C. McGovern. 2002. Life history of reef fishes and the potential for MPAs in their management and conservation. SAFMC MPA Workshops, Charleston SC and Wrightsville Beach NC. October 2002 (presented by JCM).

Sedberry, G.R., and J.C. McGovern. 2002. Research and monitoring in relation to MPA designation and design. SAFMC MPA Workshops, Charleston SC and Wrightsville Beach NC. October 2002 (presented by GRS).

In addition, we prepared presentations that were given after the project reporting period. These include the following:

Hollen, E. and L.R. Sautter. 2003. Live rocks of the shelf edge: an exploration of hardbottom microcosms. Southeast Coastal Ocean Science Conference and Workshop, Charleston SC. January 2003 (poster).

Loefer, J.K., J.C. McGovern, H.S. Meister, O. Pashuk, G.R. Sedberry and D.M. Wyanski. 2003. Exploring deep water reefs off the southeastern coast of the U.S.: an overview of Islands in the Stream 2002, Mission 1. South Carolina Fishery Workers Association and South Carolina Chapter American Fisheries Society Annual Meeting, McCormick, SC. February 2003 (presented by HSM).

Loefer, J.K., J.C. McGovern, H.S. Meister, G.R. Sedberry, D.M. Wyanski. 2003. Further evidence of the invasion of the Indo-Pacific lionfish, *Pterois volitans*, along shelf-edge reefs of the southeastern United States. Southern Division American Fisheries Society, Annual Meeting, Wilmington NC. February 2003 (poster).

McGovern, J.C., G.R. Sedberry and E.L. Wenner. 2003. The role of fishery-independent monitoring surveys in assessing the status of stocks along the southeastern U.S. Southeast Coastal Ocean Science Conference and Workshop, Charleston SC. January 2003 (presented by JCM).

Sautter, L.R., R.D. McEvers, A. Golub and S. Vettese. 2003. Project Oceanica – education through exploration; resources from research. Southeast Coastal Ocean Science Conference and Workshop, Charleston SC. January 2003 (poster).

Sedberry, G.R., and J.C. McGovern. 2003. The potential of marine protected areas for management and conservation of deep reef fishes and associated communities at the edge of the Gulf Stream. Southeast Coastal Ocean Science Conference and Workshop, Charleston SC. January 2003 (presented by GRS).

Additions were made to the Project *Oceanica* web site, which includes links to Ocean Exploration web sites (http://oceanica.cofc.edu/Underwater%20Oases%202002.htm). The *Oceanica* web site also includes original educational materials developed since the mission, including science summaries, logs, and image-rich photo and video galleries. More web pages are in progress.

Educational materials have been incorporated into high school classes taught by the two teachers-at-sea and in graduate (Fisheries Science) and undergraduate (Marine Geology) courses at the College of Charleston that are taught by project personnel. In addition, two undergraduate students at Coastal Carolina University (Conway SC) did a short project using the side scan sonar data from the unusual and interesting bottom features noted at some shelf-edge sites (i.e. "pockmarks" at the Georgetown Hole reef. They measured the orientation and dimensions of over 100 of those features recorded in the side scan sonar data. The question of the origin and nature of these mysterious features remains unanswered, but additional analyses and sonar surveys we have planned may answer the question.

Additional education activities included participation by students in preparation of outreach and education materials for the Ocean Exploration and Project Oceanica web sites, and materials for poster presentations at scientific and educational meetings. As noted above, several undergraduate students have been involved in processing of sediment data and side scan sonar records.

c. Explain special problems, differences between scheduled and accomplished work, etc.

Sample processing is behind what we originally proposed, but is proceeding as well as can be expected given the funding constraints.

2. Expenditures:

a. Describe expenditures scheduled for this project period.

Expenditures scheduled included cruise personnel and supplies, travel, and personnel/supplies for laboratory processing of samples.

b. Describe actual expenditures this quarter.

An expense statement has been sent directly by the MRD financial office to the NOAA office in Silver Spring, Maryland. Expenditures included personnel time, travel, and supplies.

c. Explain special problems, differences between scheduled and actual expenditures, etc.

No problems in expenditures were encountered during this project period. We are under spent in some budget categories, but will begin expending in those as sample processing continues.

d. Include copies of financial reports.

An expense statement has been sent directly by the MRD financial office to the NOAA office in Silver Spring, Maryland.

Prepared by: _____

Principal Investigator / signature Date

Approved by:*_____

(signature) Date

[*Note: Reports must be signed by the appropriate Principal Investigator's supervisor.]